

WE CLAIM:

1. A micro-electromechanical fluid ejection device that comprises
a substrate that defines a plurality of fluid supply channels and a plurality of chambers in
5 fluid communication with respective fluid supply channels;
a drive circuitry layer that is positioned on the substrate;
a plurality of roof structures that are connected to the drive circuitry layer to cover respective
fluid chambers, each roof structure defining a fluid ejection port; and
a plurality of actuators that are connected to the drive circuitry layer and are operatively
10 positioned at respective chambers to eject fluid from the fluid ejection ports on receipt of an
electrical signal from the drive circuitry layer, wherein
the substrate defines chamber walls that diverge from respective ink inlet channels to
respective roof structures.
- 15 2. A micro-electromechanical fluid ejection device as claimed in claim 1, in which the chamber
walls of each fluid chamber are shaped and oriented to define a four-sided pyramidal structure with
an apex that terminates at the respective inlet channel.
3. A micro-electromechanical fluid ejection device as claimed in claim 2, in which the
20 substrate is a silicon substrate and each chamber is the product of a crystallographic etch carried out
on the silicon substrate.
4. A micro-electromechanical fluid ejection device as claimed in claim 1, in which at least one
of the actuators is operatively positioned in each roof structure, each actuator being electrically
25 connected to the drive circuitry layer to be displaceable into and out of its respective chamber, on
receipt of said electrical signal, to eject a drop of fluid from the fluid ejection port.
5. A micro-electromechanical fluid ejection device as claimed in claim 4, in which a number of
actuators are positioned in each roof structure about the ink ejection port.
- 30 6. A micro-electromechanical fluid ejection device as claimed in claim 5, in which each
actuator includes an actuator arm that is connected to the drive circuitry layer and extends towards
the fluid ejection port, a heating circuit being embedded in the actuator arm to receive the electrical
signal from the drive circuitry layer, the actuator arm being of a material that has a coefficient of
35 thermal expansion sufficient to permit the material to perform work as a result of thermal expansion
and contraction, the heating circuit being positioned so that the actuator arm is subjected to

differential thermal expansion and contraction to displace the actuator arm towards and away from the respective fluid supply channel.

- 5 7. A micro-electromechanical fluid ejection device as claimed in claim 6, in which each actuator arm is of polytetrafluoroethylene while each heating circuit is one of the materials in a group including gold and copper.
- 10 8. A micro-electromechanical fluid ejection device as claimed in claim 6, in which each actuator arm includes an actuating portion that is connected to the drive circuitry layer and a fluid displacement member that is positioned on the actuating portion to extend towards the fluid ejection port.
- 15 9. A micro-electromechanical fluid ejection device as claimed in claim 6, in which each roof structure includes a rim that defines the fluid ejection port, the rim being supported above the respective fluid inlet channel with support arms that extend from the rim to the drive circuitry layer, the actuator arms being interposed between consecutive support arms.
- 20 10. A micro-electromechanical fluid ejection device as claimed in claim 1, in which the drive circuitry layer is a CMOS layer.